



**Accelerating the Development of
Earth-Abundant Thin-Film Photovoltaics**
California Institute of Technology
March 28-29, 2013

Thursday, March 28

- 8:00 – 8:45 **Registration & Breakfast** (Millikan North Lawn)
8:45 – 9:00 **Welcome: Harry Atwater**, Caltech (Millikan Board Room)
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session one **THEORY & FUNDAMENTALS** (Millikan Board Room)

Session Chairs: Harry Atwater, Caltech & Tonio Buonassisi, MIT

- 9:00 – 9:15 **Suhuai Wei**, NREL: “Defect control in CZTS solar cell absorbers”
9:15 – 9:30 **Stephan Lany**, NREL: “Optimizing the optical and electrical properties of Cu₂O by alloying with Zn and S”
9:30 – 9:45 **Elif Ertekin**, UIUC: “Design of interfaces in thin-film photovoltaics for enhanced charge separation”
9:45 – 10:30 Discussion
10:30 – 10:45 Break (Millikan Lobby)
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session two **THIN-FILM ABSORBER DEPOSITION** (Millikan Board Room)

Session Chairs: Jeff Bosco, Caltech & Vera Steinman, MIT

- 10:45 – 11:00 **Jeroen van Duren**, Intermolecular: “Combinatorial deposition enables CIGS from 0% to 17.7% efficiency in 10 months”
11:00 – 11:15 **Andriy Zakutayev**, NREL: “Combinatorial development of copper nitride absorbers”
11:15 – 11:30 **Matt Law**, UC Irvine: “Film quality assessment of pyrite grown by various techniques”
11:30 – 11:45 **Mike Scarpulla**, Utah: “Defect properties of CZTSSe”
11:45 – 12:15 Discussion
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- 12:15 – 1:00 **Buffet Lunch** (Millikan North Lawn)
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session three **MATERIALS TO DEVICES: BUFFER LAYERS & TCOS** (Millikan Board Room)

Session Chairs: Naomi Coronel, Caltech & Michael Lloyd, MIT

- 1:00 – 1:15 **Susanne Siebentritt**, Luxembourg Univ: “Detection, origin, and device impacts of microscopic inhomogeneities in chalcogenide thin films”
1:15 – 1:30 **Rommel Noufi**, NREL: “Interface control in chalcogenide devices”
1:30 – 1:45 **Philipp Hering**, Giessen Univ: “Prospects and progress of GaN/Cu₂O heterojunctions”
1:45 – 2:00 **Tonio Buonassisi**, MIT: “Operationalizing non-traditional PV materials”
2:00 – 2:15 **Harry Atwater**, Caltech: “Advances in copper oxide, zinc phosphide, and zinc IV nitrides”
2:15 – 2:30 Break (Millikan Lobby)
2:30 – 3:00 Discussion
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- 3:00 – 4:45 **POSTER SESSION & Best Poster Prize** (Millikan North Lawn)



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- 5:00 **DINNER & HISTORICAL PERSPECTIVE** (Main Lounge, Athenaeum)
Session Chairs: Amanda Shing, Caltech & Rafael Jaramillo, MIT
- 6:30 – 6:45 **Bob Birkmire**, UDel: “Cu₂S/CdS Solar Cells: Birth of Thin Film Technologies”
- 6:45 – 7:00 **Jim Stevens**, Dow: “Progress in Advancing Earth-Abundant PV Technology from the Lab to Commercial Development”
- 7:00 – 7:30 Discussion

Friday, March 29

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- 7:30 – 8:00 **Breakfast** (Millikan North Lawn)

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- session four** **DEVICE ARCHITECTURES** (Millikan Board Room)
Session Chairs: Yulia Tolstova, Caltech & Yun Seog Lee, MIT
- 8:00 – 8:15 **Klaus Ellmer**, Helmholtz: “Earth-abundant sulfides as absorbers for photovoltaics and water splitting”
- 8:15 – 8:30 **Ana Kanevce**, NREL: “Device modeling of CZTSSe solar cells”
- 8:30 – 8:45 **Joel Ager**, LBNL: “Earth Abundant p-type conductors”
- 8:45 – 9:30 Discussion
- 9:30 – 9:45 Break (Millikan Lobby)

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- session five** **APPLICATIONS & COMMERCIALIZATION PROSPECTS** (Millikan Board Room)
Session Chairs: Samantha Wilson, Caltech & Riley Brandt, MIT
- 9:45 – 10:00 **David Mitzi**, IBM: “Opportunities and current limitations of CZTS thin-film technology”
- 10:00 – 10:15 **Alex Polizzotti**, DOE: “Recommendations of High-Impact Research Pathways in Kesterite PV from a Recent Meeting on CZTS Thin Films”
- 10:15 – 10:30 **Nate Lewis**, Caltech: “EASCMs in JCAP”
- 10:30 – 11:00 Discussion
- 11:00 – 11:20 Break (Millikan Lobby)

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- session six** **DISCUSSION: LOOKING AHEAD** (Millikan Board Room)
Session Chairs: Tonio Buonassisi, MIT & Harry Atwater, Caltech
- 11:20 – 11:50 Setting Priorities for EASCM Research
- 11:50 – 12:20 Draft and share recommendations for federal agencies for opportunities in EASCMs research
- 12:20 – 12:30 **Harry Atwater**, Caltech: Workshop Closure

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- 12:30 **Box Lunch** (Millikan North Lawn)

- 1:00 – 2:00 **Lab Tours:** Atwater and Lewis Groups